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PATENT & TRADEMARK OFFICE

Attorney's Docket No.: 042390.P16836

Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:

Ioan Sauciuc, et al.

Application No: 10/683,924

Filed: October 10, 2003

For: A COMPUTER SYSTEM HAVING CONTROLLED COOLING

Examiner: Michael V. Datskovskiy

Art Unit: 2835

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF IN SUPPORT OF APPELLANT'S APPEAL TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellant hereby submits this Brief in triplicate in support of their appeal from a final decision by the Examiner, mailed on April 19, 2007, in the above-referenced case. Appellant respectfully requests consideration of this appeal by the Board of Patent Appeals and Interferences for allowance of the above-referenced patent application.

FIRST-CLASS CERTIFICATE OF MAILING

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I. REAL PARTY OF INTEREST

The real party in interest is Intel Corporation, a corporation of the United States of America having a principle place of business at 2200 Mission College Blvd., Santa Clara, California.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF THE CLAIMS

Claims 1-3, 9-20, and 14-30 are cancelled.

Claims 4-8 and 21-23 are currently pending and stand rejected by the Examiner under the Final Rejection mailed on April 19, 2007.

Claims 4-8 and 21-23, as they stand on appeal, are set forth in Appendix A.

IV. STATUS OF THE AMENDMENTS

An Amendment and Response to Office Action with Request for Continued Examination was filed on March 26, 2007. A copy of all the claims on appeal, including the amendments of March 26, 2007, enclosed herewith is attached in Appendix A hereto.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

This section of this Appeal Brief is set forth to comply with the requirements of 37 C.F.R. 41.37(c)(1)(v) and is not intended to limit the scope of the claims in any way.

The claimed subject matter relates generally to a computer system, and more specifically to systems that are used to cool a microelectronic die of a computer system. A microelectronic die has a microelectronic circuit formed therein and heats up when the circuit is operated. Heat generated by the microelectronic die has to be removed, preferably in a controlled manner, in order to avoid damage to the circuit due to excessive temperatures. (*See, e.g.*, paragraphs 0001 and 0009).

Embodiments of the claimed invention include a vapor chamber and thermoelectric module as part of a cooling apparatus. The vapor chamber serves as a heat spreader for heat from the microelectronic die. The vapor chamber has a wicking structure on internal surfaces of walls thereof, and is filled with a fluid that can condense onto or evaporate from the wicking structure. The evaporation and condensation of the fluid allows for the temperature of the lower wall of the vapor chamber to be controlled. (*See, e.g.*, paragraphs 0010-0011).

The thermoelectric module serves to cool the vapor chamber and maintain proper functioning of the vapor chamber, thus keeping the microelectronic die cooled. The thermoelectric module includes thermoelectric components which are typically a plurality of doped semiconductor components that pump heat between the upper and lower surface of the thermoelectric module in a direction depending on the dopant type and direction of current. In addition, a heat sink, fan and motor may provide additional cooling ability and control. (*See, e.g.*, Figure 1; Paragraph 0012-0015).

Embodiments of the claimed invention also include a control apparatus. The controller receives input from temperature sensors, and utilizes the input to control current to the thermoelectric module and voltage/current to a motor that drives a fan and provides additional cooling. Sensors may include: a junction temperature sensor typically located within the microelectronic chip; a cold-side temperature sensor typically located on an upper surface of a lower ceramic plate of the thermoelectric module; a hot-side temperature sensor typically located on a lower surface of an upper ceramic plate of the thermoelectric module; an ambient moisture sensor typically located at a distant location to test for moisture in the surrounding air; and a current sensor to detect current provided to the thermoelectric module, thus allowing the controller to monitor and limit power provided to the thermoelectric module (*See, e.g.*, Figure 1 and 2; paragraphs 0007-0010 and 0016-0019).

The embodiment of the claimed invention in independent claim 21 includes a computer system comprising a microelectronic die, a thermoelectric module, a fan, a motor, an input device, and a controller. The microelectronic die has an integrated circuit formed therein. The thermoelectric module is thermally coupled to the microelectronic die so as to pump heat from the microelectronic die when power is provided to the thermoelectric module. The motor is coupled to the fan to rotate the fan, so that the fan cools the microelectronic die. The controller is connected to the input device to receive a variable from the detector as an input into the controller, the controller controlling the power provided to the thermoelectric module and to the motor based on the input, such that power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value. (*See, e.g.,* Figures 1 and 2; paragraphs 0011-0021).

VI. GROUND OF REJECTION TO BE REVIEWED ON APPEAL

The ground of rejection to be revealed on appeal is:

- Whether claims 8 and 21 are unpatentable under 35 U.S.C. 102(e) as being anticipated by Meir (U.S. Patent Application Publication 2005/0174737 A1, hereinafter "Meir").
- Whether claims 22, 23 are unpatentable under 35 U.S.C. 103(a) as being obvious over Meir in view of Atkinson (U.S. Patent Application Publication 2005/0204747 A1, hereinafter "Atkinson").

- Whether claim 4 is unpatentable under 35 U.S.C. 103(a) as being obvious over Meir in view of Watanabe (U.S. Patent No. 6,817,191, hereinafter "Watanabe").
- Whether claims 5 and 6 are unpatentable under 35 U.S.C. 103(a) as being obvious over Meir in view of Richman (U.S. Patent No. 4,685,081, hereinafter "Richman").
- Whether claim 7 is unpatentable under 35 U.S.C. 103(a) as being obvious over Meir in view of Richman, and further in view of Palfy (U.S. Patent No. 6,470,696, hereinafter "Palfy").

VII. ARGUMENT

A. THE 35 U.S.C. 102(E) REJECTION OF CLAIMS 8 AND 21 ARE IMPROPER BECAUSE NO PRIOR ART REFERENCE TEACHES OR SUGGESTS THE LIMITATION THAT POWER TO THE THERMOELECTRIC MODULE IS LIMITED AND FAN SPEED IS ACCELERATED WHEN POWER TO THE THERMOELECTRIC MODULE REACHES A PREDETERMINED MAXIMUM VALUE.

Claim 21:

Independent claim 21 recites:

> 21. A computer system, comprising:
> a microelectronic die having an integrated circuit formed therein;
> a thermoelectric module thermally coupled to the microelectronic die so as to pump heat from the microelectronic die when power is provided to the thermoelectric module;
> a fan;
> a motor coupled to the fan to rotate the fan, so that the fan cools the microelectronic die;
> an input device; and

> a controller connected to the input device to receive a variable from the detector as an input into the controller, the controller controlling the power provided to the thermoelectric module and to the motor based on the input, such that power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value.

The Examiner contends that Meir teaches the limitation that power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value. The Examiner points to paragraphs 0051, 0052, and 0056 in Meir for support of this contention. Specifically, the Examiner states the following.

> *Meir in paragraph [0051] discloses that: "Preferably, the method further comprises the step of operating at least one computer case fan at a substantially lower duty cycle and therefore voltage, thereby reducing fan speed and consequently noise emission levels still further. Meir in paragraphs [0052] and [0056] discloses: "Optionally, the method further comprises the steps of sampling data from the processor temperature sensor; determining whether the sampled data is within a preselected acceptable range, and if said data is higher than the preselected range, setting PWM signal output from the microprocessor to maximum (about 100% PWM) to operate the thermoelectric element(s) at maximum power; and operating the processor cooling fan at maximum speed for maximum cooling of the processor."*

The Examiner interprets the above as follows:

> *First: With regard to the speed of the fan: Preferably fan has a lower speed, but sometimes, based on the steps of sampling data from the processor temperature sensor; determining whether the sampled data is within a preselected acceptable range, and if said data is higher than the preselected range, the speed of the fan is accelerated (for maximum), which matches the requirement of the claim 21. Second: With respect to the power to the thermoelectric module: By Meir: "...the method further comprises the steps of sampling data from the processor temperature sensor; determining whether the sampled data is within a preselected*

> *acceptable range, and if said data is higher than the preselected range, setting a PWM signal output from the microprocessor to maximum (about 100% PWM) to operate the thermoelectric element(s) at maximium power".*

As specifically stated in the section quoted by the Examiner, when "the data is higher than the preselected range," the cooling fan and the thermoelectric elements are both set at maximum power. The cooling fan thus runs at 100% speed and the thermoelectric elements are at 100% power at the same time.

This is clarified and further supported in Figure 9 and paragraph 0019, where Meir describes in detail the operation of the system when the data is higher than the preselected range. Specifically, step 816 of Figure 9 and paragraph 0019 clearly show that when the sampled temperature value is above the high threshold value of preselected range (V_L-V_H), the output level of the thermoelectric element is set to 100% and the output level of the fans are set to 100%. (Meir, paragraph 0119, step 816 of Figure 9). Note that all fans (the CPU fan, the rear and front fans, and the duct fan) are set to 100% (i.e., at maximum speed). (*See, e.g.*, Meir, step 816 of Figure 9). Thus, the power to the thermoelectric element is set to maximum at the same time that the fans are set to maximum speed. Therefore, the fans cannot be accelerated when power to the thermoelectric module reaches a predetermined maximum value because they are already at maximum.

The application as filed discloses the feature of accelerating the fan speed when the power to the thermoelectric module reaches a predetermined maximum value. (See, e.g., Figure 2, paragraphs 0020-0021). Figure 2 specifically shows that there is initially a direct relationship between motor voltage and thermoelectric voltage. Thermoelectric voltage is, however, limited and motor voltage increases after that. Meir does not disclose the feature as illustrated in Figure 2. Claim 21 specifically includes the limitation that "power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value." Claim 21 thus includes at least one limitation that is not taught nor suggested by Meir. Therefore, Meir does not anticipate claim 21, and thus claim 21 is in a condition for allowance.

Claim 8:

Claim 8 ultimately depends from independent claim 21 and thus incorporates all the limitations of claim 21. Therefore, claim 8 is in a condition for allowance for at least the same reasons set forth above for independent claim 21.

B. THE 35 U.S.C. 103(A) REJECTIONS OF CLAIMS 4-7 AND 22-23 ARE IMPROPER BECAUSE NO PRIOR ART REFERENCE TEACHES OR SUGGESTS THE LIMITATION THAT POWER TO THE THERMOELECTRIC MODULE IS LIMITED AND FAN SPEED IS ACCELERATED WHEN POWER TO THE THERMOELECTRIC MODULE REACHES A PREDETERMINED MAXIMUM VALUE.

Claim 22-23:

Claims 22-23 ultimately depend from independent claim 21 and thus each incorporates all the limitations of claim 21. As set forth above, Meir does not teach or suggest the limitation that the power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value. Furthermore, Atkinson does not teach or suggest the limitation that the power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value. Since neither Meir nor Atkinson teach or suggest all the limitations of claims 22-23, the combination of Meir in view of Atkinson does not teach nor suggest all the limitations of claims 22-23. Therefore, Applicant respectfully submits that claims 22-23 are in a condition for allowance.

Claim 4:

Claim 4 ultimately depends from independent claim 21 and thus incorporates all the limitations of claim 21. As set forth above, Meir does not teach or suggest the limitation that the power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value. Furthermore, Watanabe does not teach or suggest the limitation that the power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value. Since neither Meir nor Watanabe teach or suggest all the limitations of claim 4, the combination of Meir in view of Watanabe does not teach nor suggest all the limitations of claim 4. Therefore, Applicant respectfully submits that claim 4 is in a condition for allowance.

Claims 5-6:

Claims 5-6 ultimately depend from independent claim 21 and thus each incorporates all the limitations of claim 21. As set forth above, Meir does not teach or suggest the limitation that the power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value. Furthermore, Richman does not teach or suggest the limitation that the power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value. Since neither Meir nor Richman teach or suggest all the limitations of claims 5-6, the combination of Meir in view of Richman does not teach nor suggest all the limitations of claims 5-6. Therefore, Applicant respectfully submits that claims 5-6 are in a condition for allowance.

Claim 7:

Claim 7 ultimately depends from independent claim 21 and thus incorporates all the limitations of claim 21. As set forth above, Meir does not teach or suggest the limitation that the power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value. Furthermore, Richman nor Palfy teach or suggest the limitation that the power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value. Since Meir, nor Richman, nor Palfy teach or suggest all the limitations of claim 7, the combination of Meir, in view of Richman, in further view of Palfy does not teach nor suggest all the limitations of claim 7. Therefore, Applicant respectfully submits that claim 7 is in a condition for allowance.

VIII. CONCLUSION

For the foregoing reasons, Appellant respectfully asserts that Claims 4-8 and 21-23 overcome the cited references and are therefore patentable. For reasons presented herein, the removal of the present rejections and allowance of the present claims is respectfully requested.

Charge Our Deposit Account

If there are any further charges not accounted for herein, please charge them to our Deposit Account No. 02-2666.

Respectfully submitted,
Blakely, Sokoloff, Taylor & Zafman LLP

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IX. APPENDIX A

1 – 3. (Canceled)

4. (Previously presented) The computer system of claim 21 further comprising:

a hot plate thermally coupled to the thermoelectric module, with the thermoelectric module between the microelectronic die and the hot plate; and

a hot-side temperature sensor on a side of the thermoelectric module of the hot plate and opposing the microelectronic chip, the controller being connected to the hot-side temperature sensor to receive an indication of temperature at the hot-side temperature sensor, the controller controlling current provided to the thermoelectric module based on an input from the hot-side temperature sensor.

5. (Previously presented) The computer system of claim 21, further comprising:

a junction temperature sensor within the microelectronic die, the controller being connected to the junction temperature sensor to receive an indication of temperature at the junction temperature sensor, the controller controlling current provided to the thermoelectric module based on an input from the junction temperature sensor.

6. (Original) The computer system of claim 5, further comprising:

an ambient temperature sensor detecting ambient temperature of air distant from the microelectronic die and the thermoelectric module, the controller being connected to the ambient temperature sensor to receive an indication of temperature at the ambient temperature sensor, the controller controlling current provided to the thermoelectric module based on an input from the ambient temperature sensor.

7. (Original) The computer system of claim 6, further comprising:

an ambient moisture sensor detecting ambient moisture of air distant from the microelectronic die and the thermoelectric module, the controller being connected to the ambient moisture sensor to receive an indication of moisture at the ambient moisture sensor, the controller controlling current provided to the thermoelectric module based on an input from the ambient moisture sensor.

8. (Previously presented) The computer system of claim 21, further comprising:

an ambient temperature sensor detecting ambient temperature of air distant from the microelectronic die and the thermoelectric module, the controller being connected to the ambient temperature sensor to receive an indication of temperature at the ambient temperature sensor, the controller controlling current provided to the thermoelectric module based on an input from the ambient temperature sensor.

9 - 20. (Canceled)

21. (Original) A computer system, comprising:

a microelectronic die having an integrated circuit formed therein;

a thermoelectric module thermally coupled to the microelectronic die so as to pump heat from the microelectronic die when power is provided to the thermoelectric module;

a fan;

a motor coupled to the fan to rotate the fan, so that the fan cools the microelectronic die;

an input device; and

a controller connected to the input device to receive a variable from the detector as an input into the controller, the controller controlling the power provided to the thermoelectric module and to the motor based on the input, such that power to the thermoelectric module is limited and fan speed is accelerated when power to the thermoelectric module reaches a predetermined maximum value.

22. (Original) The computer system of claim 21, further comprising:

a vapor chamber between the microelectronic die and the thermoelectric module; and a fluid in the vapor chamber, the fluid being evaporated when heat transfers thereto from the microelectronic die and condensing when heat transfers therefrom to the thermoelectric module.

23. (Original) The computer system of claim 22, further comprising:

a cold-side temperature sensor between the vapor chamber and the thermoelectric module, the controller being connected to the cold-side temperature sensor and controlling current provided to the thermoelectric module based on an input from the cold-side temperature sensor.

24 – 30. (Canceled)

X. APPENDIX B: EVIDENCE

NONE

XI. APPENDIX C: RELATED PROCEEDINGS

NONE